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THE IMPACT OF ELECTRONIC DESPATCH ADVICE ON THE SERVICE TIME OF A MEANS OF TRANSPORT IN A DISTRIBUTION CENTER

Abstract

Purpose: The aim of the article is to verify the impact of the use of electronic notification of deliveries on the service time of a means of transport in a distribution center.

Methodology: The study used electronic notification in the form of EDI DESADV messages. The research was carried out in one of the distribution centers of a retail company operating in Poland. The study used the method of recording the time of logistics operations. The study was conducted in two stages (each lasting a week), in which the time of logistics operations was recorded in conditions without and with the DESADV message implemented.

Results: The results of the conducted research show that the use of electronic despatch advice allows you to reduce the time of handling the means of transport in the distribution center.

Conclusion: Reducing the time of handling the means of transport in the distribution center brings numerous additional benefits, such as faster release of the means of transport and enabling it to carry out subsequent transport tasks, handling a larger number of unloadings with the same number of resources (e.g. warehouse ramps), accelerating the internal process and enabling faster reloading to other means of transport performing the distribution process.

Keywords: Despatch advice, supply chain digitization, logistics operations

1. Introduction

Nowadays, there is a strong trend towards digitization of supply chains. This is the result of the implementation of the Industry 4.0 concept. Industry 4.0 can be understood as "development of production and value creation systems by linking the real and the digital world" (Hetterscheid & Schlüter, 2019). One of the guidelines of Industry 4.0 is to create links between organizations in the supply chain. These links were traditionally associated with the exchange of goods. Currently, they are increasingly associated with the exchange of data and information (Galati & Bigliardi, 2019). Digitization gives new opportunities to supply chains, primarily related to the availability of information, the ease of its exchange between companies in the supply chain, which may affect more effective inventory manage-

ment, more efficient use of resources, or the ability to react faster to changes in the environment (Bigliardi et al., 2022).

Digitization of supply chains is observed in many dimensions. It may be related to the technologies used in the acquisition, collection, processing and transfer of data, data security and the impact of data availability on the implementation of supply chain processes in the real layer.

The aim of the article is to analyze the impact of the use of electronic data exchange in the field of delivery notification (DESADV message) on the time of accepting the delivery to the warehouse. The study is a case study due to the fact that it was carried out only in one logistics center of a selected retail chain. The study used quantitative data collection and analysis methods.

2. Supply chain digitization

The digitization of the supply chain is related to the concept of Logistics 4.0. Logistics 4.0 is defined as a set of technical and organizational solutions aimed at improving the flow of materials and information enabling the implementation of the postulates of the Industry 4.0 concept (Saturno et al., 2018).

Logistics 4.0 and the digitization of supply chains use various technologies that allow data manipulation. Among these technologies, the most frequently mentioned are the Internet of Things (IoT), Artificial Intelligence (AI) or Machine Learning (ML), Augmented Reality (AR) and Virtual Reality (VR), robots, 3D printing and drones (Eckert et al., 2016). Thanks to the availability of data and AI algorithms, it is possible to communicate between machines and solve emerging problems (Dirican, 2015). The dissemination of technologies included in Industry 4.0 may even lead to the creation of digital supply chains. Supply chains carry out independent communication between enterprises, which will give completely new possibilities for production or service creation (MacCarthy & Ivanov, 2022).

Supply chain digitization also raises issues of data security and the ability to share it (in a secure way) with partners in the supply chain (Jagtap et al., 2021). Related to this issue is blockchain technology that allows data to be shared and protected in the event of an attack or failure of storage devices (Krajka et al., 2022). Blockchain technology makes it possible to track different transactions along the whole supply chain in a secure and traceable manner. The documented transactions and data are irrevocably stored in the blockchain and cannot be used or read without consensus. Every time a consignment is transported or handled, the transaction can be documented, creating a permanent history from the manufacturer to the trader or consumer (Aritua et al., 2021).

Although the practical applications of blockchain solutions in logistics are still in their nascent phase, several papers and studies have been published on blockchain in supply chains (Gurtu, 2019). A comprehensive literature review of positive impacts and challenges/barriers in maritime transport was given in Jović et al. (2020). The authors identified and described 20 positive impacts and 20 challenges (Jović et al., 2020).

Digitization brings many benefits to supply chains. Thanks to the availability of data and the possibility of their rapid exchange, the resilience of the organization and supply chains increases, i.e., "…companies can access many open datasets, and collecting and aggregating these data can improve their preparedness for future disruptive events" (Nagy & Foltin, 2022). The digitization of supply chains can also have a positive impact on the environmental performance of an organization (Hashmi et al., 2023). Many authors point out that technologies connected with Industry 4.0 and supply chain digitization enable the effective implementation of sustainable development goals (Chauhan et al., 2023).

Summing up the considerations on supply chain digitization, it should be noted that it is difficult to clearly define what a digital supply chain is and what it is not. The set of tools used under this concept is very wide and not precisely defined, which makes it much more difficult in practice to measure the effectiveness of the use of individual tools in the supply chain digitization (Mugurusi et al., 2021).

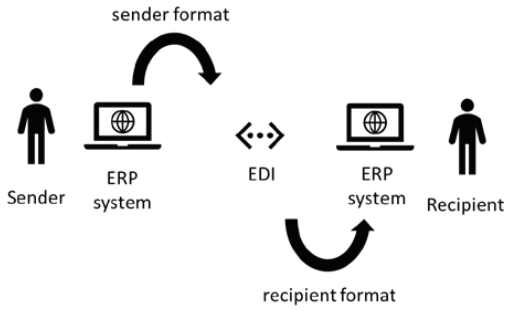
3. The role of electronic data interchange in the digitization of the supply chain

3.1 Electronic Data Interchange

Electronic Data Interchange (EDI) is the exchange of data in formats described by international standards, between IT systems of business partners, with minimal human intervention. EDI combines the possibilities of IT and telecommunications. It enables the elimination of paper documents, increas-

ing the efficiency of all activities related to the flow of goods and information. EDI is the simplest way to carry out business transactions, omitting the tedious work of creating, copying and sending paper documents. EDI directly connects IT systems of cooperating companies. EDI enables an immediate transfer of information that is contained in typical business documents. The use of standard and internationally accepted data formats ensures that all exchange participants use the same language. An EDI document is the equivalent of a paper business document in an internationally established form that has been adapted for electronic data transmission. EDI functions independently of the type of user software. The use of EDI is not limited by differences in software that business partners use in their enterprises. EDI is about exchanging data in a fixed format between IT systems, not between people. These data can be automatically processed by a computer[1].

Figure 1 Exchange of documents using Electronic Data Interchange (EDI)



Source: Authors' own study

The introduction of EDI, i.e., an exchange of documents by electronic means, solves problems related to errors and significantly reduces the time of document processing, also contributing to saving resources. The procedure is as follows (Figure 1):

1. the seller creates, for example, a notice in its IT system (Enterprise Resource Planning - ERP) and sends it in its own internal format;
2. advice, without human intermediation, is sent quickly and automatically via the EDI network to the buyer, being instantly translated from the supplier's format to the recipient's format;
3. the recipient receives the advice in its own internal format directly to its own IT system (ERP).

In this way, both companies have an advice note - each in the format of their internal system. In the same way, you can automate the transfer of other documents and data exchanged between companies. Eliminating the need for a human to rewrite documents makes data exchange quick and error-free[2].

3.2 Despatch advice in EDI

The message EDI – despatch advice (DESADV) is of key importance for this article. This message contains a specification of goods sent to the buyer. One document describes one load that can be delivered to one or more destinations - it allows the buyer to prepare for the collection of goods. The use of a reader for scanning labels with a bar code placed on shipping packaging allows you to automatically check the compliance of delivery with the previously sent shipping notification-Despatch Advice (DESADV)[3]. Large-scale retailers are increasingly demanding the use of the ASN or DESADV message from their suppliers to enhance the traceability of their trading operations and optimize the logistics chain. ASN stands for Advanced Shipping Notice, otherwise known as a shipping note. ASN is also known by the abbreviation DESADV or the term Despatch Advice when working with the EDIFACT standard, and it is widely used in other regions of the world and mainly in Europe[4].

A literature review was conducted in June 2023 based on the Scopus database, because it is the largest database of scientific publications in the world. The selection consisted in searching for selected phrases in the title, keywords and abstract. Only 3 publications were selected as part of the systematic literature search conducted in this way ("despatch advice" and "DESADV"). The first article deals with the monitoring of the Key Performance Indicators (KPI) and of the efficiency of the stock processes. The areas described in the article are some aspects of modern stock management by using the Warehouse Management System (WMS) with a focus on the processes of receiving and picking of goods.

1 https://gs1pl.org/standardy/gs1-edi, https://www.edi.pl

2 https://www.edi.pl/abc-edi, https://gs1pl.org/standardy/gs1-edi

3 https://www.gs1.org/standards/edi-xml-gs1-eancom/eancom-desadv-s4/syntax-4

4 https://edicomgroup.com/blog/asn-or-desadv-a-key-edi-message-in-the-supply-chain

In terms of goods reception, the article deals with the utilization of the Electronic Data Interchange for the Despatch Advice (EDI DESADV) in combination with the exploitation of the Serial Shipping Container Code (SSCC) during goods reception (Klabusayova, 2013). The second article describes the technique and prospects for the development of medication traceability information management. This article assesses the situation regarding regulatory and technical aspects of medication traceability – analyzing the modalities of handling traceability data, their internal and external flow organization (using e.g. DESADV) (Aiguillon et al., 2010). The third article deals with economic dispatch advice for the NETA balancing mechanism. The requirement is to define power injections and response levels to maintain a viable and economic system over the balancing period (Dyer et al., 2002).

The literature review results are so surprising, because within the phrases "electronic data interchange" and "EDI", the Scopus database shows as many as 1,315 publications. The juxtaposition of the above-mentioned phrases with a more popular science notation of the keyword in the form of "advice note" in each of the two combinations does not lead to showing any publications as the result of such a literature search.

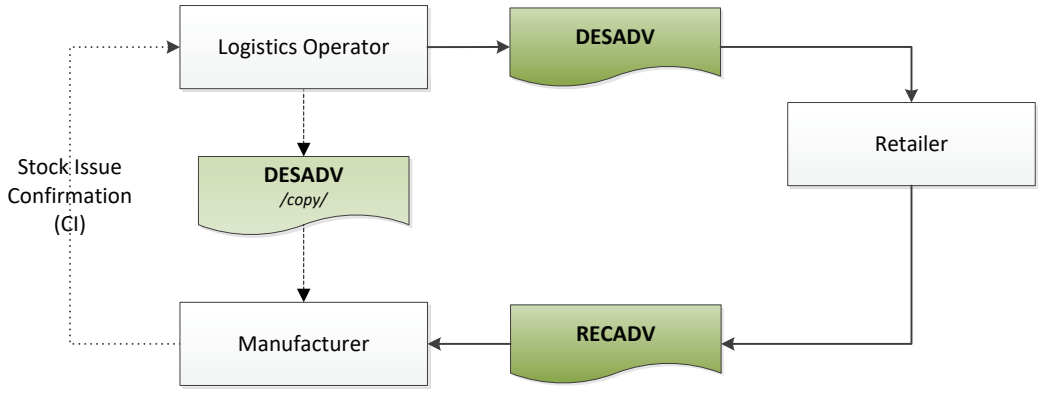
Therefore, an additional literature search was conducted ("advanced shipping notice" and "ASN"), which yielded 5 additional publications. The first article points to the need for the ASN capability concerning mixed pallets (Chiappinelli, 2008). The second article deals with supply chain integration and specifically concentrates on the importance of information distribution among various parties in the chain to make the chain visible (Marufuzzaman & Halim, 2006). The third article evaluates the benefit of a strategy of sharing shipment information, where one stage in a supply chain shares shipment quantity information with its immediate downstream customers - a practice also known as advanced shipping notice (Zhang et al., 2006). The fourth article discusses the development of documents that prescribe the organization and labeling of shipments to the receiving docks. The people on the receiving docks that suppliers order from prefer some features like receipt of an electronic advanced shipping notice (ASN) (Apple, 2003). The fifth article identifies the areas within purchasing where costs have been reduced through direct electronic transmission of standard business forms (purchase orders, advanced shipping notices, invoices, etc.) between two organizations and provides estimates of the size of these reductions. Reduction of workload for purchasing professionals resulting from EDI implementation is also documented (Carter & Fredendall, 1990).

4. Analysis of research results

4.1 Methodology

The research methodology is based on the diagram shown in Figure 2. This diagram follows the methodology of the pilot implementation of the paperless concept presented in the paper (Cudzilo & Kolinski, 2022).

Figure 2 Relationships in the flow of messages in the supply chain



Source: Ł-PIT research, (Cudzilo & Kolinski, 2022)

The research methodology proposed in the paper (Cudzilo & Kolinski, 2022) is the basis for conducting analyses of the impact of using the paperless concept on logistics process efficiency in the supply chain. Benefit analysis by comparing the pre-implementation state and the post-implementation state in the same period allowed minimizing the risk of comparing different current states, caused, for example, by the seasonality of supplies from a given manufacturer, or sales peaks. The proposed benefit analysis methodology makes it possible to multiply this method of analysis to further partners in the supply chain. However, as indicated, the results of the analysis of the benefits of the pilot implementation proved insufficient to conduct detailed research.

During the pilot study, an additional indicator was defined in the supply chain which is, from the perspective of the supply chain under study, important to demonstrate the benefits of implementing electronic documents (DESADV, RECADV). The indicator of the time taken to receive a delivery in the warehouse (pallet counting time) is the main indicator conditioned by the use of DESADV and, at the same time, an indicator that influences the parameter related to the driver's time in the DC, which is why the counting time was analyzed first. It is important to note that during the ongoing study, the counting time was only measured for the pallets from the manufacturer - the company involved in the implementation of the paperless concept.

The first step is to establish the objectives of the complementary research carried out. It was agreed to measure the times over the course of two weeks, i.e.:

- Week 1: /21 June - 27 June 2022/ - DESADV for all manufacturer deliveries to DC.
- Week 2: /28 June - 4 July 2022/ - no DESADV for manufacturer deliveries to DC.

Two exactly the same (in terms of duration) time segments (7 days) were intentionally defined to ensure relevance of measurements.

4.2 Result analysis

All deliveries in the first week were to be advised by the logistics operator electronically (using DESADV) in line with the standard for this supply chain.

For the test in the second week, advice of delivery was to be deactivated, meaning deliveries were to be made over the following 7 calendar days without electronic advice (without DESADV).

The overall result in terms of the counting time is shown in Table 1.

Table 1 Overall result of the study in terms of time taken to receive pallets into the warehouse (pallet counting time) during the examined weeks

Week	Average pallet counting time [minutes]	Average number of pallets per reception	Number of orders
Week 1 (with DESADV)	6.9	18.4	18.0
Week 2 (without DESADV)	9.9	21.3	13.0

Source: Authors' own study

As shown in Table 1, the time taken to count pallets from the manufacturer, or the time taken to receive a delivery (of Lactalis pallets) in the warehouse, was 3 minutes (or 31%) shorter in week 1, i.e., the week when the DESADV message was used (in relation to week 2 - without DESADV).

In addition, the average number of manufacturer pallets per reception, i.e. per order, was checked and once again the number of orders was quoted for both weeks under study. This information is presented in the last two columns in Table 1, respectively. It turns out that the average number of pallets per admission process was lower in week 1, but more orders were handled in this week.

The average number of pallets per acceptance (per order) was lower in week 1 (averaging 18 pallets per order in week 1 and 21 pallets in week 2), but more orders were handled in that week (18 orders in week 1 and 13 orders in week 2). A smaller number of pallets per reception (order) recorded in week 1 may have an impact on the achieved result regarding a shorter counting time in week 1; nevertheless, the pallet counting time per pallet still remains shorter in week 1.

The average number of pallets per reception (reception in relation to 1 order) can affect the result in terms of the counting time, especially in the first week. The point is that if reception is done with reference to DESADV, then each pallet has to be scanned separately, even if there are exactly the same goods on each pallet (and in the entire delivery). If, on the other hand, in a manually accepted delivery (week 2 - without DESADV) all pallets are identical (1 good in the delivery), the warehouse worker does not check all pallets but manually enters the total number of pallets (scans only the first pallet of a given index and manually enters multiples of pallets).

Continuing this topic, it was examined how the manufacturer's pallet counting time developed as a function of the number of pallets in reception (resulting from the order). The results are shown in Table 2.

Table 2 Average counting time per interval determined by the number of pallets received

	Counting time [minutes] per order				
Pallets in delivery	0-5	6-10	11-15	16-20	26-33
Week 1 (with DESADV)	7.7	4.0	5.3	-	8.5
Week 2 (without DESADV)	3.0	8.5	20	8.0	11.1

Source: Authors' own study

As can be seen in Table 2, in most of the intervals conditioned by the number of pallets in reception, the counting time is clearly longer in week 2 (without DESADV). An exception is the interval characterizing receptions with a maximum of 5 pallets. In week 1, there were 3 such receptions, in week 2, there were two. It appears that these smallest orders are most often homogeneous, i.e. they refer to one product in the delivery. As a result, in the case of week 1 - all pallets have to be scanned separately, which takes longer than in the case of week 2, where in this situation (1 good in the delivery) only one pallet is scanned (without reference to DESADV) and the total number of pallets in the delivery is entered (without scanning them). Larger deliveries (more than 5 pallets) generally contain a larger number of goods, including mix pallets, and in this type of situation, the counting time is much shorter if the counting is done with reference to DESADV (according to Table 2):

- 2.1 times shorter (113% shorter) for deliveries containing 6 to 10 pallets,
- 3.8 times (281% reduction) for deliveries containing 11 to 15 pallets,
- 1.3 times (31% reduction) for deliveries containing 26 to 33 pallets.

From the analysis presented, it can therefore be concluded that the counting time, i.e. the time it takes to receive a delivery at the recipient's warehouse, is reduced as a result of the DESADV message, regardless of the number of manufacturer's pallets in the delivery.

This confirms the conclusion reached during the pilot study: Delivery acceptance efficiency on the recipient's side is improved due to the reduction in delivery acceptance lead times.

Accordingly, in the additional study described in this paper, as a result of DESADV, the acceptance time was reduced by 31%; during the pilot study, a result of 44% was achieved in this regard.

Discussing the preliminary results of the survey with DC, the staff also identified that there are a number of additional factors that may affect counting times. On the one hand, it could be the fact that smaller deliveries generally have a smaller number of indexes - this factor has already been discussed above. On the other hand, another factor that the staff paid attention to was the organization of work in the process of receiving goods into the warehouse. In fact, for the measurement to be meaningful in this context, deliveries would always have to be counted by the same employee (throughout the test). In practice, however, this is not possible, and in the counting process over the two weeks when the test took place, different employees were involved and their approach to carrying out the admissions process may be different (e.g., a different pace of work), which in turn may affect the pallet counting time.

5. Conclusion

The conducted research shows that the use of EDI messages (in this particular case, DESADV) allows to reduce the time of unloading the means of transport in the distribution center. The use of electronic data interchange allowed, on average, to reduce the service time of the means of transport by 31%.

The use of the DESADV message therefore allows for a better use of resources of both the supplier and the customer. Reducing the execution time of the acceptance process allows for the implementation of a larger number of acceptances using the same resources. This is particularly important in food supply chains, and in particular temperature-controlled chains. In the case of these chains, on the one hand, the time factor is decisive for the freshness of the products (the possibility of their quick reloading for downstream transport), and on the other hand, the resources used to accept these goods into the warehouse are more expensive. Therefore, the impact of implementing DESADV messages on reducing logistics costs is much greater.

According to the authors, the described research is a significant addition to the research gap in the form of a lack of quantitative research on the impact of the use of electronic data exchange in the field of advice notes on the course of the delivery acceptance process. A literature search did not yield any publications that would present such research results. This publication, therefore, opens a new area of research with a high practical implication.

The presented research, although carried out on the case study, allows the claim that the use of electronic data exchange in the field of advice notes allows shortening the process of receiving goods to the warehouse. It is interesting that the impact of electronic notification is not uniform and depends on many factors. In the conducted research, only two factors were distinguished, i.e., the number of pallets accepted in the delivery and the variety of the assortment included in the delivery. The less complicated the delivery (the fewer assortment items and the smaller number of pallet load units), the smaller the impact of electronic notification on the shortening of the acceptance time. This observation should be confirmed in subsequent studies.

Conducting the study in only one distribution center is a serious limitation of the possibility of interpreting the results. Therefore, in the next step of research, it is necessary to increase the number of enterprises and industries, and thus the characteristics of the adoption processes they implement. Taking action will allow you to collect more data and show more relationships between the implementation of DESADV and the time of delivery acceptance. It will be necessary to determine the variables affecting the shortening of time and to verify this effect on the basis of the observations made.

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